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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/986,919	11/13/2001	Jeawoan Lee	1567.1021	6274
21171	7590	04/12/2004	EXAMINER	
STAAS & HALSEY LLP SUITE 700 1201 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			TSANG FOSTER, SUSY N	
			ART UNIT	PAPER NUMBER
			1745	

DATE MAILED: 04/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 09/986,919	Applicant(s) LEE ET AL.	
	Examiner Susy N Tsang-Foster	Art Unit 1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) 32-41 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>20011113</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election with traverse of Group I in Paper No. 20040107 is acknowledged. The traversal is on the ground(s) 1) that claims 32-41 are so closely related to elected claims 1-31 that they should remain in the same application to avoid imposing any undue burden, expense, and delay on the Applicants in preserving the invention recited in claims 32-41, and 2) that there have been no references cited to show any necessity for requiring restriction and that in fact, it is believed that the Examiner would find references containing both method and product claims in the same field of technology and as such it is believed that the Examiner's search would naturally encompass both technologies because a total of 114 patents have been issued into class 429, subclass 235 and a total of 153 patents have been issued in class 29, subclass 2 since 1976 and at least 14 patents roughly are in both classes and subclasses.

This is not found persuasive because the class and subclass cited for each of the two groups for the restriction requirement are original classes for classification purposes and additional classes and subclasses are also searched for each of Groups I and II. For example, class/subclass 29/623.1, drawn to a method of making a battery which includes making the electrode would also be searched at minimum for Group II and that class/subclass contains 1022 patents and 233 patent application publications. Another class/subclass of search for group II is 427/58 drawing to producing an electrode by a coating process which contains 928 patents and 251 patent application publications. Another class/subclass of search for group II is 429/623.5 drawn to a method of making an electrochemical cell comprising the step of coating or

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impregnating which contains 655 patents and 116 patent application publications. For Group I, areas of search include at least 429/218.1 which is drawn to chemically specified inorganic electrochemically active material containing, 429/231.95 which is drawn to an electrochemically active material containing lithium, and 429/234 drawn to a grid or holder has nonconducting component portion thereof. Class/subclass 429/218.1 contains 535 patents and 123 patent application publications. Class/subclass 429/231.95 contains 563 patents and 283 patent application publications. Class/subclass 429/234 contains 277 patents and 24 patent application publications. Class/subclass 29/2 contains 355 patents and 45 patent application publications. Class/subclass 429/235 contains 154 patents and 33 patent application publications. Evaluation of both sets of claims would be undue burden upon the examiner.

Applicant also asserts that MPEP 803 sets forth the criteria for restriction between patentably distinct inventions as A) indicates that the inventions must be independent or distinct as claimed, and B) indicates burden on the Examiner if restriction is required. Applicant states that beyond showing separate classifications, the Examiner has not set forth sufficient evidence to show that the Examiner will experience a serious burden without imposing restriction that is out of proportion with the serious burden and inconvenience visited upon the applicant if restriction is required.

In response, the Examiner has met the two criteria required in MPEP 803 for restriction. First, the Examiner has provided sound reasoning in the previous written restriction requirement that the product can be made by a patentably distinct process thus satisfying requirement A and specifically recited U.S. Pat. No. 6,548,210 B1 to provide evidence that the product can be made by a different method. Secondly, to provide evidence of undue burden on the Examiner, MPEP

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808.02 states that for related but distinct inventions, undue burden exists if one or more of the following can be shown: A) separate classification, b) separate status in the art if inventions are classifiable together, or c) a different field of search is shown even if the inventions are classifiable together. The Examiner has provided evidence for at least one of (a) through (c) by showing separate classification, separate status in the art by their different classes of search, and different fields of search for Group II that are not required for Group I such as class/subclass 29/2, 427/58, 29/623.1, and 29/623.5 although Group I and II may be classifiable together as asserted by applicant.

Although applicant elected the invention of Group I, claims 1-31, applicant still did not elect a single species from each of the two categories of species set forth in the previous written election requirement. It appears that applicant has misunderstood the species election requirement of the previous communication. Applicant was required to elect a single species from Group I of species for the sulfur-based active material (first category of species) and a single species from Group II of species for the negative active material (second category of species). In the interest of advancing prosecution, the Examiner is withdrawing the election of species requirement.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 32-41 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Applicant timely traversed the restriction (election) requirement in Paper No. 20040.

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***Priority***

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

***Information Disclosure Statement***

4. The information disclosure statement filed 11/13/2001 has been considered by the Examiner.

***Drawings***

5. The drawings were received on 11/13/2001. These drawings are approved by the Examiner.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 2 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 2 and 14, the limitation “wherein the sulfur-based active material is at least one selected from the group consisting of elemental sulfur, solid  $\text{Li}_2\text{S}_n$  ( $n \geq 1$ ), a catholyte in which  $\text{Li}_2\text{S}_n$  ( $n \geq 1$ ) dissolves, an organosulfur compound, and a carbon-sulfur polymer” is indefinite because it is unclear to the Examiner whether a catholyte containing  $\text{Li}_2\text{S}_n$  ( $n \geq 1$ ) is being claimed

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or a catholyte having a property such that  $\text{Li}_2\text{S}_n$  ( $n \geq 1$ ) can dissolve therein and not necessarily containing  $\text{Li}_2\text{S}_n$  ( $n \geq 1$ ) is being claimed.

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1, 2, 5-14, 17-27, 30, and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by Chu et al. (US 6,030,720).

The product-by-process limitations of claims 5, 9, 10, 17, 21, and 22 are not given patentable weight since the courts have held that patentability is based on a product itself, even if the prior art product is made by a different process (see In re Thorpe, 227 USPQ 964, (CAFC 1985), In re Brown, 173 USPQ 685 (CCPA 1972), and In re Marosi, 218 USPQ 289, 292-293 (CAFC 1983)).

In claim 5, the product by process limitation “wherein said porous current collector comprises a resin foam coated with a metal, where the coated resin foam is subjected to a

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pyrolysis process” is not given patentable weight in a product claim. Therefore, a porous metallic current collector would meet the claim limitation.

In claim 9, the product by process limitation “wherein the metal is coated using a coating method that comprises one of electroplating and electroless plating” is not given patentable weight in a product claim.

In claim 10, the product by process limitation “wherein the metal is coated using a coating method that comprises one of electroplating and electroless plating” is not given patentable weight in a product claim.

In claim 17, the product by process limitation “wherein the porous current collector comprises a resin foam coated with metal, where the coated resin foam was subjected to a pyrolysis process” is not given patentable weight in a product claim. Therefore, a porous metallic current collector would meet the claim limitation.

In claim 21, the product by process limitation “wherein the metal is coated using a coating method that is one of electroplating and electroless plating” is not given patentable weight in a product claim.

In claim 22, the product by process limitation “wherein the metal is coated using a coating method that is one of electroplating and electroless plating” is not given patentable weight in a product claim.

The present claims are drawn to a positive electrode comprising a sulfur based active material and a lithium sulfur battery comprising the positive electrode comprising a sulfur based



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active material where the disclosed inventive concept appears to be a positive electrode porous current collector in which the sulfur based active material is disposed.

Chu et al. disclose a lithium sulfur battery comprising a positive electrode comprising a current collector that can be a conductive foam or a thin conductive grid such as a metal-coated polymer fibers or weaves in which the positive electrode material is interspersed throughout the matrix provided by the current collector (col. 9, lines 15-37 and Figures 2A and 2B).

Conductive foam or thin conductive grid such as a metal coated polymer fibers or weaves inherently are porous since they provide a matrix in which the positive electrode material is interspersed. The reference also states that the matrix is sufficiently "open" that there is room for precipitated electroactive material to deposit on the matrix (col. 10, lines 39-56). The positive electrode material is interspersed through the matrix provided by the current collector (col. 9, lines 27-30). Current collector materials may be made of a material such as aluminum that is resist to degradation in the electrochemical environment of the cell (col. 8, lines 13-34).

The positive electrode material may be elemental sulfur, sulfides, polysulfides, redox sulfur polymers (col. 6, lines 5-42 and col. 19, lines 6-15), and  $\text{Li}_2\text{S}_x$  where x is a value of 1 or greater (col. 9, lines 40-55). The positive electrode material may be interspersed into the current collector material by providing a slurry containing the sulfur based active material, a suitable binder, electroconductive agent, and solvent (col. 17, lines 24-40) and coating the slurry onto a porous current collector such as carbon fiber paper (col. 17, lines 30-35) where the carbon fiber paper is impregnated with the slurry and the solvent is evaporated (col. 23, lines 23-50 and col. 19, lines 45-58).

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The negative electrode material may be lithium metal, lithium alloy, carbon based-lithium ion which reversibly intercalates and deintercalates lithium ions (col. 21, lines 1-46). A separator separates the positive electrode and the negative electrode and may be glass, plastic, ceramic, or a polymeric entraining liquid electrolyte (col. 8, lines 43-61). The battery contains a liquid electrolyte containing a lithium salt which impregnates (permeates) the negative electrode, positive, electrode, and separator (col. 14, lines 43-67 and col. 16, lines 1-6) and where the electrolyte also transfers lithium metal ions (col. 10, lines 1-6).

10. Claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-28 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Chu (US 5,686,201).

See col. 1, lines 19-27; col. 4, lines 29-63; col. 5, line 9 to col. 6, line 14; col. 11, lines 50-60; col. 12, lines 7-30; especially col. 15, lines 4-20; col. 16, lines 60-67; col. 17, lines 50-67 of the reference.

11. Claims 1, 2, 5, 9, 11, 13, 14, 17, 21, 23, and 25-27 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Barton et al. (US 6,503,432 B1).

See col. 1, lines 29-35; col. 7, lines 57-67; col. 9, line 40 to col. 10, line 20; especially col. 12, lines 15-35 of the reference.

***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 3, 4, 15, 16, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (6,030,720) in view of Palmer (US 4,508,608).

Chu et al. ('720) disclose all the limitations of claims 3, 4, 15, 16, and 29 except that the current collector comprises at least 60% porosity or at least 80 to 90% porosity.

Palmer et al. teach that a current collector should be 90 to 97% porous as substrates for cathodes of lithium ion secondary batteries because such porosity would provide a cathode with high porosity so as to allow extensive electrolyte solvent communication throughout the bulk of the cathode and also increase cathode real surface area which in turn would greatly improve cell current density.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the porosity of the current collector of Chu et al. ('720) to be 90 to 97% porous because such porosity would provide a cathode with high porosity so as to allow extensive electrolyte solvent communication throughout the bulk of the cathode and also increase cathode real surface area which in turn would greatly improve cell current density as taught by Palmer et al.

### ***Conclusion***

14. Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster, Ph.D. whose telephone number is (571) 272-1293. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (571) 272-1292.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

st/



Susy Tsang-Foster  
Primary Examiner  
Art Unit 1745